Space Weather Technical Forecast

Issued on Wednesday, 28 February 2024 at 12:34 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Ongoing chance of M or X flares from AR3590 in the northwest.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Low with peak flare C5.1 at 28/0909 UTC from a filament eruption in the southeast. AR3590 remains the largest and most significant potential flare source. The magnetic structure of the group remains relatively simple, with the spot aligned E-W and only limited mixing of polarities. However, there persists the large delta spot within its intermediate spots. This spot also has a large amount of associated flux, increasing the potential for larger flares, should any occur. The other regions are smaller, however AR3595 and AR3596 are both potential sources of activity, with the former seeing ongoing growth as it spreads and simplifies into a more mature bipolar spot, while the latter has a N-S alignment that can be associated with increased activity.

Two CMEs of note were observed. The first from the south centre disc, due to the filament eruption from around 27/1100 UTC. Analysis of this CME has it missing to the south, with a slight chance of a glancing blow. The Second is from a filament eruption from the southeast of the disk around 28/0909 UTC associated with a mid-level C-class flare. Imagery of this eruption is in the process of being analysed.

Solar Wind / Geomagnetic Activity: Solar winds eased after the recent weak coronal hole influence from CH01/-, with a minor enhancement after 28/0600 UTC. Speeds, as recorded by ACE, eased from slightly elevated, to background, before increasing to slightly elevated again by the end of the period. Density remained below average throughout. Interplanetary magnetic field (IMF), Bt was weak throughout, remaining below 5nT. The north-south component followed a similar pattern and was mostly weakly negative throughout. Phi angle was mainly negative (towards the Sun). Geomagnetic activity was Quiet to Unsettled (Kp 1-3).

Energetic Particles / Solar Radiation: GOES18 high energy (greater than 10MeV) proton flux was at background. High energy electron flux (greater than 2MeV) observed at GOES16 was also at background with the associated 24 hour fluence well below the Active (1e8 integrated pfu) threshold. The observed 24-hour fluence at 28/0000UTC was 1.18e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate activity expected with isolated M-class flares. There remains a slight chance of X-class flares from AR3590.

Solar Wind / Geomagnetic Activity: The CME from the filament eruption on 27 Feb appears likely to miss to the south with at most only a glancing impact on day 4 (02 Mar). Analysis of a filament eruption from the southeast of the disk around 28/0909 UTC associated with a mid-level C-class flare is still underway. Otherwise, no significant enhancements are expected with mainly background winds expected. Geomagnetic activity is likely to remain Quiet with only a chance of isolated Unsettled or Active intervals.

Energetic Particles / Solar Radiation: GOES18 high energy proton flux is likely to stay at background, but is likely to respond to any notable flares from AR3590, due to its position on the

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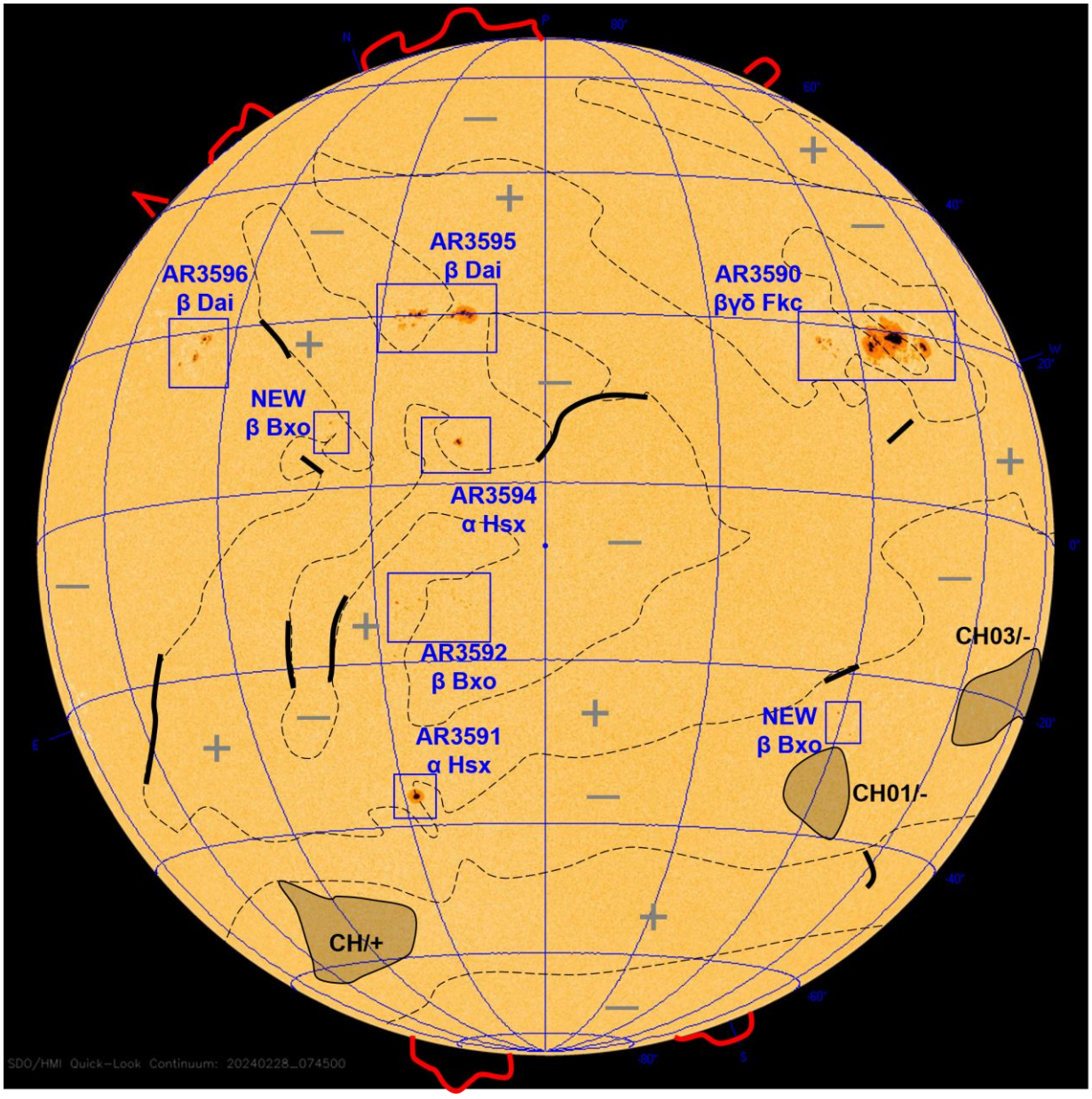
western disc. This brings a slight chance of exceeding the S1 Minor Radiation Storm level through the period. GOES16 high energy electron flux is expected to remain at background with the associated 24 hr fluence remaining below the Active threshold throughout.

Figure 1. Solar Analysis Valid 28/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

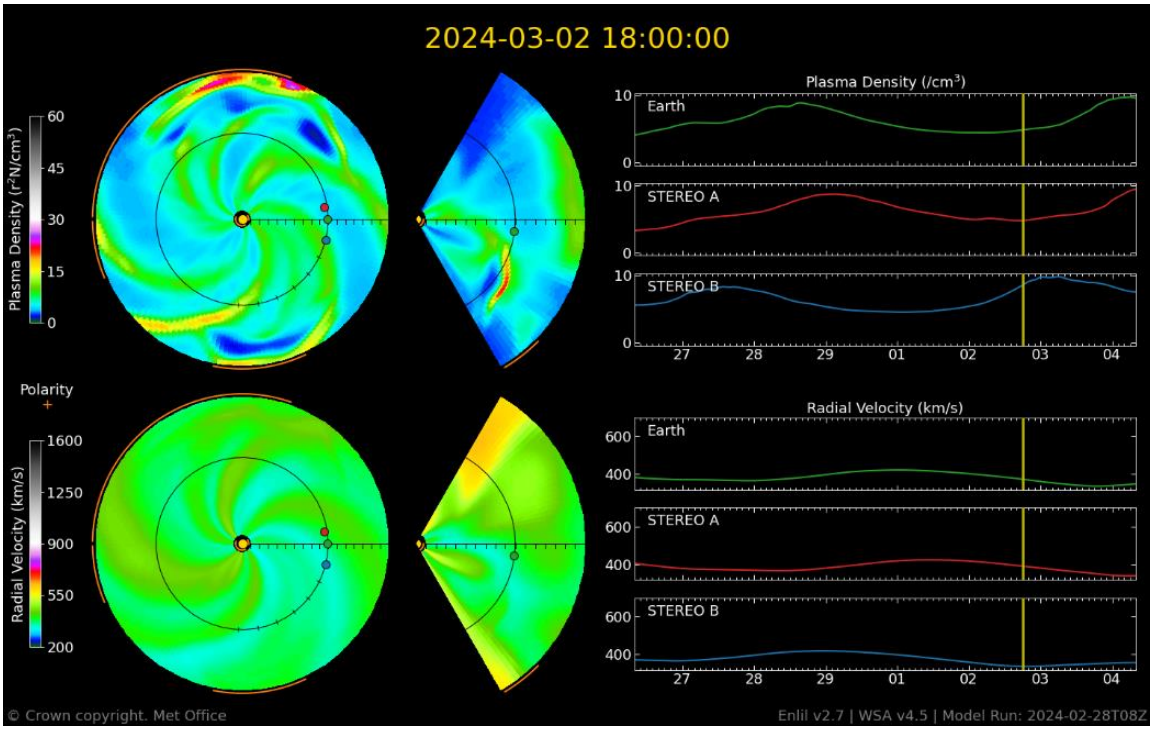
No Earth-directed CME's were observed, though a CME from a filament eruption off the southern-centre disc on 27 Feb has been analysed as passing south of Earth on day 4 (2 Mar). Analysis of a filament eruption from the southeast of the disk around 28/0909 UTC associated with a mid-level C-class flare is still underway.

Solar winds are currently slightly elevated, due to the recent interaction from CH01/-. No further notable enhancements are expected with any other coronal holes on the disc too far south to influence Earth. This is supported by MOSWOC enlil which forecasts solar winds to persist at the background to slightly elevated level, between 350 and 450 km/s.

Geomagnetic activity is forecast to be Quiet with a chance of isolated Unsettled intervals. There is a slight chance of Unsettled to Active intervals day 4 (2 Mar) if any CME glance was to occur.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	Yes	1	1	1	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: MOSWOC ENLIL



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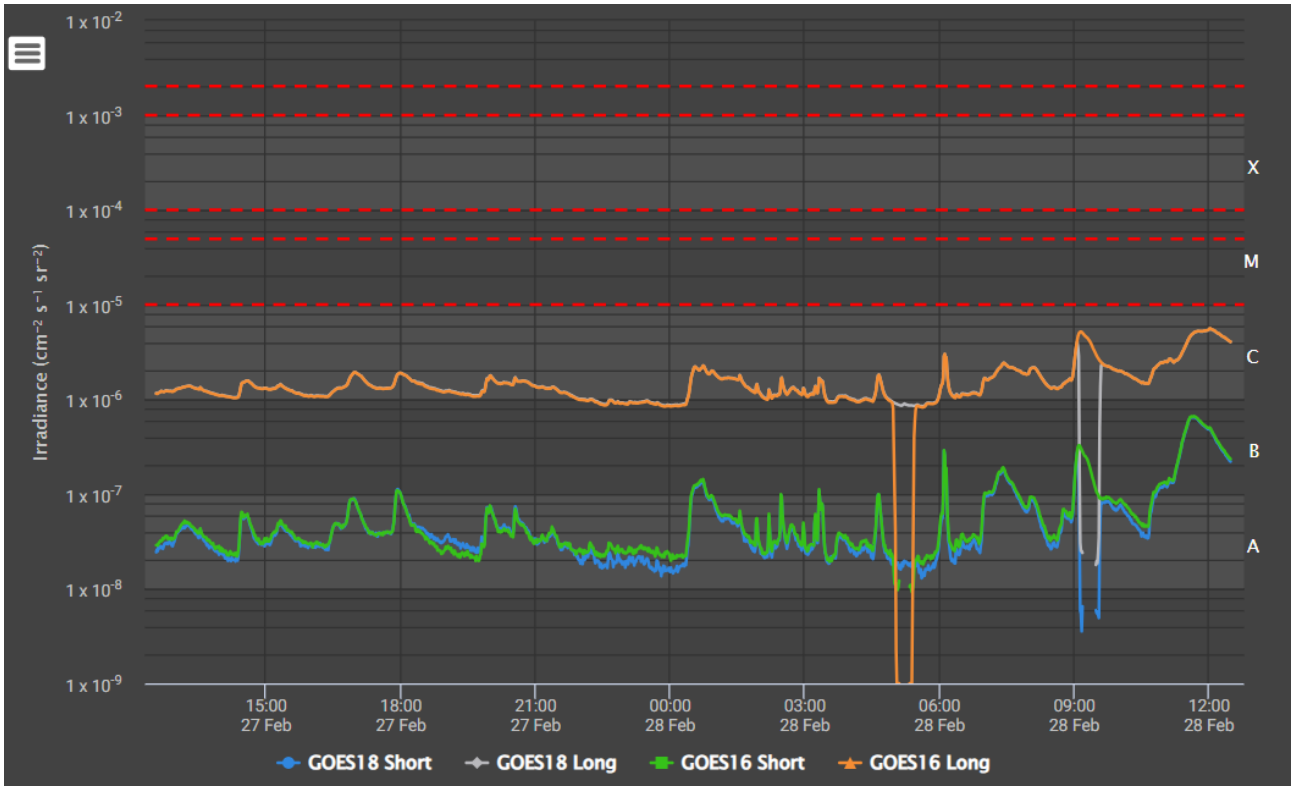
Radio Blackouts - X-Ray Flares:

Isolated M-class flares are considered likely, with a slight chance of X-class flares. The strongest flares are most likely to be from AR3490.

There are eight sunspot regions on the disc, two of which are yet to be numbered. AR3590 remains the largest and most significant potential flare source. The magnetic structure of the group remains relatively simple, with the spot aligned E-W and only limited mixing of polarities. However, there persists the large delta spot within its intermediate spots. This spot also has a large amount of associated flux, increasing the potential for larger flares, should any occur. The other regions are smaller, however AR3595 and AR3596 are both potential sources of activity, with the former seeing ongoing growth as it spreads and simplifies into a more mature bipolar spot, while the latter has a N-S alignment that can be associated with increased activity.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	60	60	60	60
Very Active	R3 to R5 X Class	No	20	20	20	20

Figure 3: 24 Hour X-ray trace.



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Solar Radiation Storms - (High Energy Protons):

GOES-18 proton flux is currently at background, and is expected to persist at this level. There is a slight chance of enhancement as AR3590 moves across the western disc, with this region now in a prime location for any large flares to also result in an observable proton enhancement at Earth. This is low confidence however, due to the regions current relative low activity, and relatively simple configuration despite its size and the presence of a large delta spot.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	20	20	20	20
Very Active	**≥ S3 ***	No	5	5	5	5
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

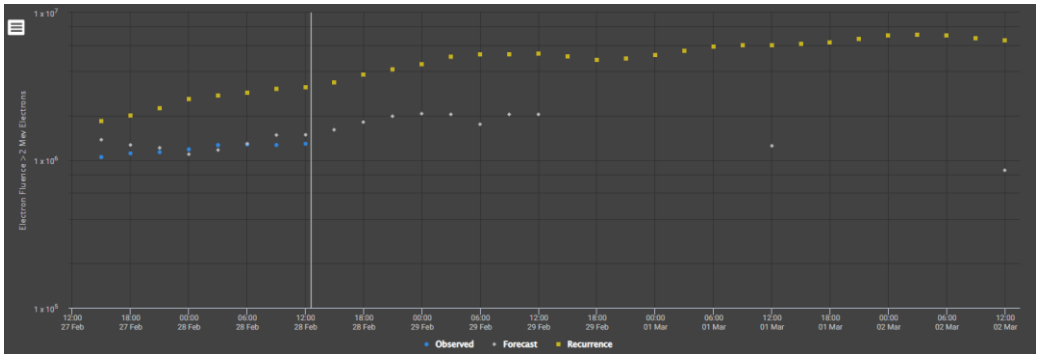
High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2MeV) as observed by GOES-16 is currently background. Recent fast wind enhancement from CH01/+ was a relatively weak affair, despite the observed G1 Minor Storm, and the GOES-16 electron flux is expected to persist at background. No further notable enhancements are forecast

The associated 24 hour fluence is expected to persist at background, with REFM currently giving good guidance to expected conditions.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 5: MOSWOC REFM



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